N°. XIX.

Aſtronomical Obſervations, Communicated by DAVID RITTENHOUSE.

Obſervations of a lunar Eclipſe, Nov. 2d, 1789, and of the tranſit of Mercury over the Sun's diſk. Nov. 5th the ſame year, made at the Univerſity of William and Mary, By the Revd DR. JAMES MADISON.

Read Feb. 4th, 1791. AS the obſervatory in which the tranſit inſtrument had been formerly placed, was not, at this time, rebuilt, I was not enabled to attend to the going of the time-keeper, by means of ſuch obſervations as I wiſhed to have made. I therefore had recourſe to correſpondent double altitudes, taken with a ſextant. In taking them, treacle was uſed, which not only gave a well defined image of the ſun, but was of ſufficient conſiſtency to prevent undulation, eſpecially as the obſervations were made in a room, where the wind could have but little effect. From the great care employed, I think the time and rate of the clock were known with very conſiderable accuracy.

Nov. 2d, A mean of the correſponding altitudes taken this day, made the clock 17′, 17″ ſlower than apparent time; to which 9″½ being added for change of declination in the half interval, hence the clock was ſlow of the ſun, - - - 17′ 26″ 30″′

Obſervations of the lunar Eclipſe.

	App. Time. H. ′ ″
Penumbra--thought to touch the ☽ at	6 8 46
Eclipſe begins, - - -	6 21 0
Tycho begins to immerge -	6 38 45
wholly immerged - -	6 43 ″

Shadow

	App. Time. H. ′ ″
Shadow reaches mare nectaris -	7 34 0
Tycho begins to emerge, - -	7 57 44
wholly emerged, - -	8 1 26
End of the Eclipſe. - -	8 30 0

Theſe obſervations were made with an achromatic teleſcope, magnifying about 60.—The immerſion and emerſion of tycho were particularly noted, as thoſe times may be more accurately aſcertained, than either the beginning or end of a lunar eclipſe—The weather was remarkably favourable for aſtronomical obſervations.

November 3d. Cloudy no Obſervations could be made.

November 4th Correſponding altitudes.

A M.	P. M.		′	″	‴
8 23 52	3 0 16	Clock ſlow by each obſervations,	17	56	
25 34	50 35	- - -	17	55	30
27 15	56 55	- -	17	55	
8 29 35	2 54 36	- -	17	54	30
31 12	52 50	- -	17	55	
32 34	51 16	- -	17	55	
8	2				
36 24	47 54	- -	17	56	
38 10	46 1	- -	17	54	30
A mean of the above obſervations, =			17	55	11
Add equal for ½ Interval, =		-	-	9	30

Hence the clock at apparent noon was ſlow of the ⊙ - - - 18 4 41

November 5th, Correſponding Altitudes.

A M.	P M.		′	″	‴
8 34 39	2 38 54	Clock two ſlow,	18	11	30
36 14	41 5	= =	18	15	30

				′	″	‴
8	40 43	2 45 12	- -	18	11	30
	42 32	47 15	- -	18	11	30
	44 30	48 58	- -	18	18	
A mean, =		- - -		18	13	36
Equal of $\frac{1}{2}$ interval, = +		- -			9	
Hence the clock was ſlow of the, ⊙				18	22	36

It appears that the clock, by comparing the obſervations, loſt, between the 2d. and 4th. 38″ 11‴ or 19″ per day, and between the 4th. and 5th. 17′ 55‴ or 18″.—Hence we may conclude that its rate of going was regular, and that it loſt 18″$\frac{1}{2}$ in 24 hours. The following obſervations were corrected accordingly, and reduced to apparent time.

Obſervations of the Tranſit of Mercury.

The 1ſt internal contact, was not ſeen. When I firſt diſcovered ☿, he was ſomewhat advanced upon the ſun's limb, and had an oval appearance, the longer axis directed towards the body of the ſun.—But at 8ʰ. 3′. 10″ The planet ſuddenly aſſumed a round figure, and the firſt internal contact was accordingly noted.

The 2d, internal contact, 12. 53 42.

The 2d, external contact could not be determined with any tolerable accuracy on account of the remarkable undulatory motion which appeared upon the ſun's limb, ſoon after the 2d internal contact. Mercury diſappeared to me, at, 12ʰ 55′ 2″. I made uſe of an achromatic, magnifying about 150.

Mr. Andrews, profeſſor of mathematics, with a reflector made by ſhort, and with a magnifying power of 90—made the following obſervations.

The 2d internal contact	- -	12ʰ	53′ 48″
2d external contact	-	12	55 19

The

The ſame undulatory appearance was not ſeen in the reflector, and therefore the 2d external contact obſerved by it, may be more relied upon—The times of our obſervations were taken from the ſame clock, but noted in different rooms—The day was remarkably favourable, being clear and ſufficiently calm.

By *D. Rittenhouſe*, at Philadelphia,

Lat. 39°. 57′. 10″. Long. weſt of Greenwich 5ʰ. 0′. 35″.

November, 2d, 1789. Moon eclipſed

Beginning	6ʰ	12′	} P. M.	mean time.
End at	8	20		
Digits eclipſed,		4½		

Tranſit of Mercury November 5th, 1789.

Firſt external contact	7ʰ	51′	50″	A. M.	Mean time
Internal	7	53	20		
Second internal contact	12	43	24	P. M.	
End of the tranſit	12	45	4		

The undulation of the ſun's limb was ſo great that no micrometer meaſures could be taken with accuracy, but the leaſt diſtance of the centers ſeemed to be 7′. 15″.

October 22, 1790. Moon eclipſed

Beginning at	5ʰ.	41′.	+″	P. M. mean time
Beginning of total darkneſs	6.	49.	9	
End of total darkneſs	8.	30.	16	
End of the eclipſe	9.	37	25	

November 6th, 1790. Sun eclipſed.

Beginning at	12ʰ.	2′	55″	P. M. mean time.
End at	2.	1	54	

If this eclipſed be computed from Mayer's tables it will be found advanced 33″, at the time ſet down above for the beginning, and by Maſon's new tables 29″. And it is certain that an eclipſe muſt make ſome progreſs before it will be perceived by the moſt attentive obſerver. The end was no doubt obſerved with more accuracy, and at that time

Mayer's tables give the limbs ſeperated 8″, and Maſon's the eclipſe ſtill remaining 6″. Therefore Maſon's tables repreſent both the beginning and end of this eclipſe more accurately than Mayer's, but the difference is very little. Mr. Maſon has placed the moon's nodes 51″, more forward, but this eclipſe will be better repreſented by retaining the place of the node as given by Mayer.

Tranſit of Mercury, obſerved at Waſhington College November 5th, 1789. By the Rev. Dr. *William Smith.*

N. B. The clock was cleaned and ſet a going P. M. November 4th, its rate of going, as to mean time, uncertain; but at ſun riſe November 5th, as nearly as could be gueſſed, it was about 2′. 30″ faſter than apparent time.

External contact 8ʰ. 3′. 50″ } A. M.
Internal 8. 5. 0 } Magnifying power 95.

Micrometer meaſures of neareſt limbs.

h	′	Inch.	16ths.	20ths.	5coths.	′	″
9.	19	= 0.	6.	1.	19.	= 6.	4
	54	= 0.	9.	0.	0.	= 7.	57
10.	31	= 1.	0.	0.	0	= 8.	50
	53	= 0.	9.	1.	9	= 8.	23
11.	38	= 0.	7.	0.	6	= 6.	17
12.	0	= 0.	5.	0.	20	= 4.	46

Second internal contact 12ʰ. 55′. 10 } P. M.
Total egreſs 12. 56. 35 } Magnifying power 130.

h	′	Inch.	10ths.	20ths.	′	″
⊙'s diameter at 12.	15.	= 3	6	1	= 32	14,5

Annular Eclipſe of the Sun, April 3d, 1791. Obſerved at Philadelphia, by *D. Rittenhouſe.*

Beginning (ſun juſt above the horizon) about - - 5ʰ. 45′. 30″
Ring formed nearly, at 6. 50. 30
The ring broken 6. 54. 47
End of the eclipſe, 8. 7. 2
} A. M. Mean time.

At the middle of the eclipſe the ring was nearly twice as broad at the ſouth ſide as at the north ſide.

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